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ABSTRACT

The Mathematical Sciences Education Board (MSEB) is one of the nine major units of the National Research Council (NRC). It was established to provide a continuing national overview and assessment capability for mathematics education. This report describes the activities and accomplishments of the MSEB under the following headings: (1) "Everybody Counts"; (2) "Curriculum Philosophy and Framework"; (3) "Strands of the K-12 Curriculum"; (4) "A Year of National Dialogue"; (5) "PTA Kits"; (6) "Making Mathematics Work for Minorities"; (7) "Mathematics Education: Wellspring of U.S. Industrial Strength"; (8) "Wellspring Offspring"; (9) "Pilot State Mathematics Coalitions"; (10) "Professional Standards for Mathematics Teachers"; (11) "Workshop for Federal Agencies"; and (12) "NCTM Standards Review." Other components include a 1989-1990 activity plan with the MSEB master plan and a funding plan of the Board. MSEB sponsors of core and project activities are listed, and a membership roster is provided. (YP)

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ANNUAL REPORT

OF THE

MATHEMATICAL SCIENCES EDUCATION BOARD

JUNE 1989

The primary purpose of the Mathematical Sciences Education Board is to provide a continuing national overview and assessment capability for mathematics education.

NATIONAL ACADEMY OF SCIENCES/NATIONAL ACADEMY OF ENGINEERING
NATIONAL RESEARCH COUNCIL

2101 CONSTITUTION AVENUE NORTHWEST, WASHINGTON, DC 20418

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INTRODUCTION

The Mathematical Sciences Education Board (MSEB) was established in 1985 to provide a continuing national overview and assessment capability for mathematics education. The National Research Council's (NRC's) special concern with the quality of mathematics education is based on two considerations:

- o Mathematics is the foundation discipline for science and engineering; consequently, it plays a key role in the health of the U.S. scientific and technical enterprise.

- o Increasingly, mathematics education will be a significant factor in determining the strength of the nation's work force and the opportunities open to individuals.

The MSEB's basic concern is with excellence in education for all students.

The concept of the Mathematical Sciences Education Board was brought to the NRC by the mathematics community in February 1985. It was endorsed by the NRC Governing Board and resources were provided from the NRC Fund to support initial activities. The Board was formally launched in October 1985, with a charge to provide:

- leadership of continuing efforts to improve mathematical sciences education nationally;

- coordination among existing mathematics education projects;

- service to localities and states, through assistance in determining curricular goals and higher standards for all students, and improving teacher preparation;

- recommendations of ways to strengthen weak parts of the infrastructure of mathematics education;

- information to increase public understanding of the rapidly changing missions and character of the mathematical sciences;

- advice to federal, state, and local agencies on long-range goals and needs in mathematical sciences education.

The Board has 34 members and constitutes a unique coalition of mathematics teachers and supervisors, college and university mathematicians, educational administrators, parents, and representatives of government, business, and industry. In the Board membership are the presidents (past, current, and elect) of many of the major organizations concerned with mathematics education and others in national leadership positions in the education community. In its first three-and-one-half years, the MSEB has developed a wide-ranging set of activities to carry out its charge. Much of the work of the Board is done through six committees. Five are responsible for major areas of concern -- Curriculum and Instruction, Student Assessment, the Teaching Profession, Outreach and Impact, and Minorities Issues. The sixth, the Executive Committee, bears responsibility for basic planning and coordination.

ACTIVITIES AND ACCOMPLISHMENTS

The publication of *Everybody Counts* marks the end of the first phase and the beginning of the second phase of the MSEB's long-term leadership effort in revitalizing mathematics education in U.S. schools and colleges. The report analyzes the problems, charts a course for the future, and outlines a national strategy for pursuing that course. The stage is now set for putting in place mathematics curricula which are more directly relevant to the needs of today's young people, who will live and work in the twenty-first century. Many organizations are working in this direction -- the National Council of Teachers of Mathematics (NCTM), the Mathematical Association of America (MAA), the American Association for the Advancement of Science (AAAS), the National Parent Teacher Association (PTA), and others -- and the MSEB is cooperating with each of them.

The MSEB has particularly important roles to play in the years ahead -- building consensus on national goals for mathematics education, developing appropriate models for curricula and assessment techniques, and establishing new mechanisms to link major constituencies to the reform effort, which is certain to last for decades. Described below are the programs that the MSEB has under way as it carries out this mission.

Everybody Counts

Everybody Counts, an overview and analysis of U.S. mathematics education, was released to the public at a press conference on January 26, 1989, at the National Academy of Sciences. It has attracted nationwide media coverage -- television, radio, newspapers, magazines -- and has generated extensive discussion and debate. Issues debated publicly include the role of rote learning; whether current reform efforts are the "new math" all over again; and the use of hand-held calculators in the classroom. The extent and level of coverage and debate have exceeded expectations and indicate widespread and intense interest in mathematics education in the schools.

Over 25,000 complimentary copies of *Everybody Counts* and 12,000 copies of its summary were mailed to leaders in scientific, engineering, and educational organizations and to key public officials -- members of Congress, mayors of major cities, superintendents of schools, etc. In addition, the National Academy Press (NAP) has sold more than 16,000 copies of the report.

A reprint run of 15,000 summaries was completed early in May, to fill 8,000 orders in hand and meet a large demand for further complimentary copies. Orders for the summary range in size from a single copy to 1200 copies, and include groups ranging from book publishers to boards of education.

The extent of concern with the quality of mathematics education can also be seen from the list of organizations supporting publication and dissemination of *Everybody Counts*:

Exxon Education Foundation
National Aeronautics and Space Administration
National Institutes of Health
National Research Council (NRC Fund)
National Science Foundation, Directorates for
- Biological and Behavioral and Social Sciences
- Computer and Information Science and Engineering
- Engineering
- Geosciences
- Mathematical and Physical Sciences
- Science and Engineering Education

Shell Oil Company Foundation
The Teagle Foundation
U.S. Department of Defense
- Air Force Office of Scientific Research
- Army Research Office
- National Security Agency
- Office of Naval Research

U.S. Department of Energy

Subtitled 'A Report to the Nation on the Future of Mathematics Education', *Everybody Counts* was developed jointly with the Board on Mathematical Sciences (BMS) and the Committee on Mathematical Sciences in the Year 2000 (MS2000). It was written by Professor Lynn Arthur Steen, St. Olaf College, as a synthesis of the thinking of the 70 members of the two NRC boards and MS 2000. Professor Kenneth Hoffman, Massachusetts Institute of Technology, wrote the summary. Ms. Audrey Pendergast of the MSEB staff was responsible for editorial and production coordination.

Curriculum Philosophy and Framework

Everybody Counts will be followed by publication in fall 1989 of *Perspectives on School Mathematics: A Philosophy and Framework for the Curriculum.* This can best be described as a bridging document, connecting *Everybody Counts* to the *Curriculum and Evaluation Standards* published in March 1989 by the National Council of Teachers of Mathematics, and looking a bit farther into the future. It will emphasize two developments expected to have dramatic effects on future curricula: computer technology; and changing perspectives on mathematics.

Professor Steen has undertaken final preparation of the framework, based on a report from the MSEB's ad hoc Curriculum Task Force, which was chaired by Professor Anthony Ralston of the State University of New York, Buffalo. Preparation and dissemination of this report are being supported by grants from the NRC's Kellogg Fund and from the Educational Foundation of America. The earlier work of the Curriculum Task Force was supported by a grant from the National Science Foundation.

Strands of the K-12 Curriculum

Last year, the MSEB received a grant from the Carnegie Corporation of New York to support work on "strands" of the K-12 mathematics curriculum. The idea was to take a bold step in thinking about future mathematics curricula. That is, instead of perpetuating the basic organization of today's mathematics curricula (e.g., arithmetic, algebra, geometry, etc.), to start anew looking at the fundamental ideas of mathematics which could serve as strands around which totally new curricula might be developed.

The MSEB has commissioned five outstanding mathematicians and mathematics educators to take one fundamental mathematics concept each and lay out his or her thoughts on how understanding of it might be developed over the school years, starting in kindergarten. The strands and their authors are:

CHANGE, Ian Stewart, University of Warwick
DIMENSION, Thomas Banchoff, Brown University
QUANTITY, James Fey, University of Maryland
SHAPE, Marjorie Senechal, Smith College
UNCERTAINTY, David Moore, Purdue University

It is hoped that this volume will stimulate widespread discussion in the mathematics community about what the strands of the curriculum should be and how they should be woven together.

Professor Lynn Steen is serving as the editor of the volume. Each author has a "sounding board" of individuals to react to his or her ideas and to provide advice on the final essay. The target date for publication is December 1989. Dr. Linda Rosen is the MSEB staff officer for this project.

A Year of National Dialogue

The MSEB has received a major grant from the Carnegie Corporation of New York to conduct *A Year of National Dialogue on Mathematics Education.* The funding will be used to stimulate as widespread a dialogue as possible -- a dialogue to be carried out by many different organizations at national, state, and local levels. Thousands of individuals -- teachers, research mathematicians, parents, and business and industry representatives -- are expected to be active in making the year a success. Dr. Robert Kansky, of Texas A&M University, recently joined the MSEB staff to direct this project.

PTA Kits

One of the most important and potentially powerful forces for change in mathematics education is the parent. In an effort to encourage parents to help their children succeed in mathematics, the Exxon Education Foundation has made a major grant to the National PTA and a coordinated, technical assistance grant to the MSEB for the development and dissemination to PTA's of 32,000 kits, *Math Matters - Kids are Counting on You.*

In May 1989, all elementary and intermediate school PTA presidents received an attractive kit containing many ideas for parent/child activities, a motivational videotape, posters, a calculator appropriate for elementary school students (Texas Instruments TI-108), stickers, gift ideas, and many other suggestions to PTA's about how they can help parents to stimulate and sustain their children's interest in mathematics.

Funding has been sought from the Carnegie Corporation of New York for 20,000 additional kits to be sent to elementary school principals with the joint sponsorship of the National Association of Elementary School Principals (NAESP) and the National PTA.

Development of the kits has been a cooperative effort directed by Mrs. Ann Kahn, consultant to MSEB and past president of the National PTA, with contributions from the American Federation of Teachers, Texas Instruments Incorporated, National Aeronautics and Space Administration, National Council of Teachers of Mathematics (NCTM), Family Math, Fairfax County (Virginia) School System, University of Chicago School Mathematics Project, Educational Testing Service, and the Urban League Math Project.

Making Mathematics Work for Minorities

The Exxon Education Foundation also has made a major grant to the MSEB to conduct a program of activities entitled *Making Mathematics Work for Minorities*. The goals of this project are: (1) to bring national attention to both the importance of helping more minority students succeed in mathematics and the new opportunities to achieve this goal that the reform movement in mathematics education presents; (2) to identify mathematics programs in which minorities are especially successful; and (3) to devise means whereby the MSEB can couple minority advocacy groups to the long-term revitalization effort in mathematics education.

A steering committee of 15 leaders from minority and mathematics organizations, chaired by J. Arthur Jones, Century Technologies, Inc., will oversee the planning of six regional conferences (Seattle, Irvine, Chicago, San Antonio, Philadelphia, and Atlanta) and a national convocation (Washington, D.C.).

Regional workshop directors met at a May 19-20 kick-off conference held at the National Academies' Beckman Center in Irvine, California. The MSEB project director is Dr. Beverly Anderson of the University of the District of Columbia.

Mathematics Education: Wellspring of U.S. Industrial Strength

On December 15-16, 1988, the MSEB hosted a national symposium on the issue of the mathematics education needed in the workplace, now and in the future. The symposium was held as one of the opening events of the Beckman Center.

Representatives of some 40 corporations -- ranging from Boeing to Burger King -- were there to talk about the changing workplace and to explore how mathematics education could serve their needs more effectively. The symposium was chaired by Mr. John D. Macomber, former chief executive officer of the Celanese Corporation. The MSEB staff officer for the project is Dr. John Clement. The proceedings of the symposium is under preparation. A set of working papers prepared by the participants is available upon request. The symposium and follow-up activities have been supported by a grant from the Weingart Foundation.

The MSEB now proposes to establish a Corporate Council for Mathematics Education, which will link corporate leaders with the mathematics education reform movement.

Wellspring Offspring

At the January 1989 meetings of the American Mathematical Society and the Mathematical Association of America in Phoenix, the MSEB and the Joint Policy Board for Mathematics organized an evening session on the theme of mathematics in the national agenda. Vice Admiral Studeman, director of the National Security Agency, spoke on "Mathematics: A Challenge for Business, Government, and Academia." Frederick Roesch, senior vice president of Citibank, N.A., and William Dennis Jr. of the National Federation of Independent Business, spoke on "Mathematics and the Nation's Work Force."

This session was the first in the MSEB's efforts to generate dialogue between the mathematics community and employers on the issues of mathematics education -- what employers need and how the educational system can provide it.

Pilot State Mathematics Coalitions

Another facet of the MSEB's program of activities grows out of the recognition that the real action in education is not at the national level, but at the state and local levels. To assist state-level groups to form for the purpose of improving the quality of mathematics education in the schools and colleges within particular states, the Exxon Education Foundation has made a grant to the MSEB. This grant includes some funds for grants which the MSEB will give, in turn, to fledgling state coalitions.

During May and June 1989, the MSEB will conduct in four cities (Birmingham, Salt Lake City, Kansas City, Philadelphia) exploratory meetings to gather information about how such state groups might get started and how the MSEB can help most effectively. All 50 states will be represented. Grants will be made to state groups in the fall of 1989. Dr. Robert Kansky is the MSEB project director.

Professional Standards for Mathematics Teachers

A fourth Exxon Education Foundation grant to the MSEB is designated for the development of a plan for determining ways by which the mathematics community can come to agreement on a set of standards for excellence in the teaching of mathematics. The MSEB is working cooperatively with the NCTM and the MAA to prepare a two-to-three-year plan involving the entire community.

Standards on the teaching of mathematics developed by the mathematics community should be highly influential in encouraging teachers to enlarge their repertoire of teaching strategies, as specified in the NCTM *Standards* and as described in *Everybody Counts*. It is hoped that these standards will be used in the voluntary certification program that the National Board for Professional Teaching Standards is putting together. Dr. Linda Rosen is the MSEB staff officer for this project.

Workshop for Federal Agencies

On March 22, the MSEB conducted a one-day workshop for representatives of some 43 federal agencies on the topic of *Making U.S. Mathematics Education the Best in the World: The Role of Federal Agencies*. This workshop, which had several hundred attendees, was organized in cooperation with the Federal Interagency Committee on Education (FICE). Mrs. Ann Kahn, MSEB consultant, coordinated this event for the MSEB. Mr. LeRoy Walser, executive director of FICE, was the coordinator for the Department of Education.

NCTM Standards Review

The MSEB is just completing a coordinated project with the National Council of Teachers of Mathematics. The MSEB conducted 18 focus group sessions of parents, school administrators, school board members, scientists, engineers, research mathematicians, and others on the draft NCTM *Standards*. The views expressed at these focus group sessions formed part of the basis for revision of the Standards document released on March 21. An *Analysis* of the results is now being completed, and will assist the MSEB and the NCTM in identifying stumbling blocks to implementation of the Standards. MSEB staff officers Dr. Linda Rosen, Ms. Audrey Pendergast, and Dr. Bernice Kastner have been responsible for various phases of the project. The project has been supported by a grant from the National Science Foundation.

Guide for Speakers

With funding from the National Science Foundation, the MSEB has prepared *A Guide for Speakers* on *U.S. School Mathematics from an International Perspective*. This *Guide* contains 20 slides and the text for a 30-minute presentation on the findings of various international studies of mathematics education. Copies have been sent to several hundred leaders in mathematics and education around the country. MSEB staff members Dr. Linda Rosen, Dr. Bernice Kastner, and Ms. Audrey Pendergast have been responsible for development of the *Guide*.

Mathematical Sciences in the Year 2000 (MS 2000)

MS 2000 is a joint project of the MSEB and the National Research Council's Board on Mathematical Sciences (BMS). The goal of the project is to develop a plan for the revitalization and renewal of collegiate mathematics.

The steering committee of 21 mathematicians, statisticians, scientists, engineers, and leaders in public policy was chaired for the first year by Mr. J. Fred Bucy, former chief executive officer of Texas Instruments Incorporated. The current chairman is Dr. William E. Kirwan, recently appointed president of the University of Maryland. Serving as vice chairman is Professor Ramesh Gangolli, University of Washington. Dr. James Voytuk, former associate director of the American Mathematical Society (AMS), has replaced Dr. Bernard Madison as the project director.

By summer, MS 2000 expects to publish a background report on the mathematics pipeline, tentatively entitled *A Challenge of Numbers*. A similar paper on resources for collegiate mathematics is in preparation, and work has just begun on a background paper dealing with curricula. The final report of MS 2000 should be completed in November 1990. The work of MS 2000 is supported by grants from the National Science Foundation and the National Security Agency.

MSEB Staff Grows to Thirteen

Since June 1988, the MSEB fulltime staff has grown from nine to thirteen. New staff members are Dr. Beverly Anderson, Study Director, and LaVerne Evans-McDonald, Administrative Secretary, for the Making Mathematics Work for Minorities project; and Dr. Robert Kansky, Study Director, and Linda Jones, Administrative Secretary, for the Pilot State Coalitions Project. Jane Heckler serves as Executive Assistant to Marcia Sward replacing Administrative Secretary, Grace Kulnarong. As noted above, the new Project Director for the joint BMS-MSEB Project is Dr. James Voytuk.

MSEB Staff

Marcia P. Sward, Executive Director
Kenneth M. Hoffman, Executive Director Designate
John R.B.-Clement, Senior Program Officer
Linda Rosen, Program Officer
Beverly Anderson, Program Officer
Robert Kansky, Program Officer
Julie Kraman, Administrative Associate
Jane Heckler, Executive Assistant
Linda Jones, Administrative Secretary
LaVerne McDonald, Administrative Secretary
Joan Rood, Administrative Secretary
Claudette Brown, Senior Secretary

Consultants

Kathleen Holmay, Public Information
Ann Kahn, Public Affairs
Bernice Kastner, Education Research
John H. Lawson, Education Agencies

MS 2000 Staff

James Voytuk, Senior Program Officer
Therese Hart, Research Associate

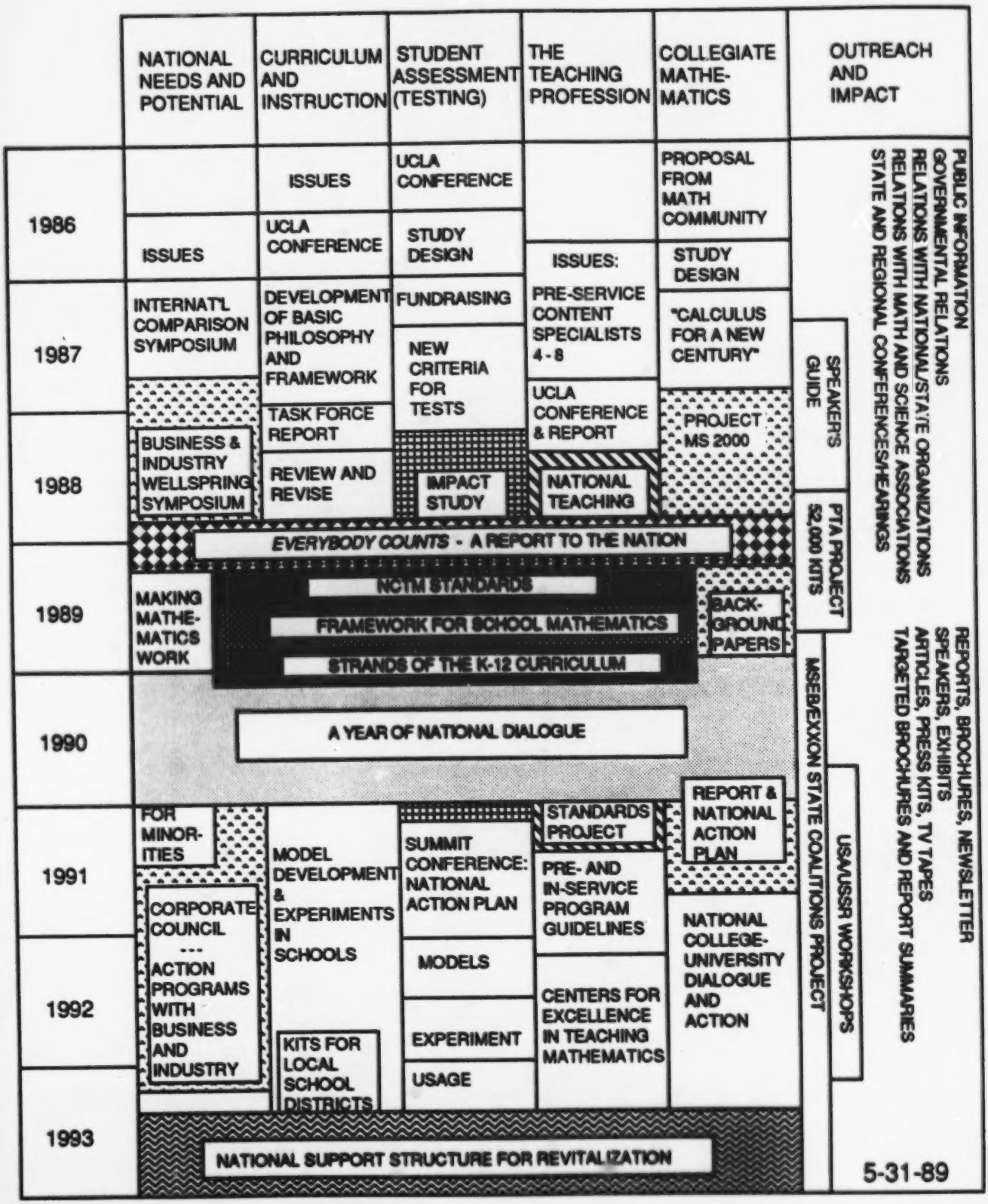
THE YEAR AHEAD

Activities, events, and reports now planned by the MSEB and other groups should make 1989-1990 the most dynamic and active year in the history of mathematics education in the United States. Highlights include:

Summer 1989:	Pilot State Coalitions, four regional workshops plus planning and implementation grants for Exxon/MSEB to developing coalitions in 6-10 states.
Fall 1989:	*Perspectives on School Mathematics: A Philosophy and Framework for the Curriculum*, MSEB's master plan for the revamping of school mathematics over the next two decades.
Fall 1989:	Making Mathematics Work for Minorities, six regional workshops leading to a national convocation.
Winter 1989-90:	*Strands of the Mathematics Curriculum*, MSEB's report on themes running through mathematics at all levels.
Calendar 1990:	A Year of National Dialogue, MSEB-coordinated dialogue among the constituencies of mathematics education.

The chart on the following page indicates how these events and reports fit into the overall plan of MSEB activities.

MSEB MASTER PLAN



FUNDING PLAN

Four characteristics of the program of the Mathematical Sciences Education Board distinguish it from any previous undertaking in mathematics education:

The scope of MSEB's concerns and involvement in education, reflected in its project organization chart.

The planning MSEB uses to coordinated its work in one area with work being done in related areas of education, either by MSEB or by other organizations around the country.

The direct interaction of MSEB with all the major participants in mathematics education, including state and local education authorities, teacher groups, education research organizations, textbook publishers, software developers, school boards, business and industry, parent groups, etc.

The sustained attention MSEB is intended to provide over many years, developing and publishing for the nation periodic assessments of the state of mathematics education in our schools and colleges, and continuously revising its national agenda for attaining excellence in mathematics education for all students.

These characteristics have significant implications for the MSEB's internal organizations and its funding plan:

- The Board itself must be large, to reflect diverse perspectives on mathematics education (presently, it has 34 members and meets three times a year to provide appropriate oversight for the many educational projects of MSEB).

- There must be a strong Executive Committee (now with 8 members who meet every other month), plus a central staff (6 members) to carry out basic planning and coordination.

- There must be an additional component of the core staff (an outreach staff of about 5) responsible for developing and maintaining the necessary contacts with state (and some local) education agencies, with scientific and education organizations, and with mathematics education's many ultimate users and attentive publics.

Both funding and staff for the core activities of the Board and the Executive Committee -- oversight, analysis, planning, coordination, and communication with education's many constituencies -- must be put on a solid, long-term basis, relatively invulnerable to the waxing and waning of public attention to the basic problems of education. Funding and staff for individual education projects will be of relatively short duration (the lifetime of the project), although the total sizes of budget and staff for such projects will be significantly larger than those for core activities.

Four Year Objectives

To achieve its goals, the current MSEB Funding Plan calls by 1993, for:

- o Growth of support for education projects from the current level to about $5,000,000 per year.

- o Growth in core funding from the present level of $560,000 to about $1,000,000 annually, with

  - approximately 80% (800,000) to come from foundations and government sources, with state funding gradually replacing part of the federal science agency support; and

  - about 20% ($200,000) to be provided by endowment funds.

Specifics for Fiscal Year 1989

In fiscal year 1989, support for education projects totaled about $1,178,000. Support for core project activities totaled $560,000 -- a $50,000 grant for the Teagle Foundation plus $510,000 from a coalition of federal science agencies. A list of sponsors and projects in FY 1988 begins on the following page.

The goal for core activities' support in fiscal year 1990 is $800,000. Educational project support is expected to total about $2,000,000.

MSEB SPONSORS

CORE ACTIVITIES

Department of Defense

- Air Force Office of Scientific Research, Division of Mathematical Sciences
- Army Research Office, Division of Mathematical Sciences
- National Security Agency, Mathematical Sciences Program
- Office of Naval Research, Division of Mathematical Sciences

Department of Energy

- Office of Energy Research, Division of University and Industry Programs

National Aeronautics and Space Administration

- Educational Affairs Division

National Institutes of Health

National Research Council

- Executive Office
- Project Initiation and Proposal Preparation Funds

National Science Foundation

- Directorate for Science and Engineering Education
- Directorate for Mathematical and Physical Sciences
- Directorate for Biological and Behavioral and Social Sciences
- Directorate for Computer and Information Science and Engineering
- Directorate for Engineering
- Directorate for Geosciences

Shell Oil Company Foundation

Teagle Foundation

MSEB SPONSORS

PROJECT ACTIVITIES

Carnegie Corporation of New York

For preparation of a report on the *Strands of the K-12 Curriculum*

For development and support of *A Year of National Dialogue*

Educational Foundation of America

For the publication and dissemination of *Perspectives on School Mathematics: A Philosophy and Framework for the Curriculum*

Exxon Education Foundation

For staff support and coordination of *Math Matters - Kids are Counting on You* a kit for elementary school PTA's developed and disseminated by the National PTA

For development of *Pilot State Mathematics Coalitions*

For regional conferences and national symposium, *Making Mathematics Work for Minorities*

For planning development of *Professional Teaching Standards in Mathematics*

National Research Council-Kellogg Fund

For final redrafting of *Perspectives on School Mathematics: A Philosophy and Framework for the Curriculum*

National Science Foundation

Directorate for Science and Engineering Education

For collegiate project, Mathematical Sciences in the Year 2000

Directorate for Science and Engineering Education

For project to review and analyze *Curriculum and Evaluation Standards for School Mathematics*, developed by the National Council of Teachers of mathematics

Weingart Foundation

For study/symposium, *Mathematics Education: Wellspring of U.S. Industrial Strength*

Mathematical Sciences Education Board
Membership Roster
1988-1989

Shirley A. Hill, Chairman; 1989
Curators' Professor of Mathematics and Education
University of Missouri-Kansas City
(Kansas City, Missouri)

Iris M. Carl, Vice Chairman; 1992
President, National Council of Supervisors of Mathematics
President-elect, National Council of Teachers of Mathematics
Elementary Mathematics Instructional Supervisor
Houston Independent School District
(Houston, Texas)

J. Myron Atkin; 1989
Professor of Education
Stanford University
(Stanford, California)

Lillian C. Barna; 1991
Superintendent of Schools
Tacoma School District #10
(Tacoma, Washington)

C. Diane Bishop; 1990
State Superintendent of Public Instruction
Arizona Department of Education
(Phoenix, Arizona)

Constance Clayton; 1991
Superintendent of Schools
School District of Philadelphia
(Philadelphia, Pennsylvania)

John A. Dossey; 1989
Past-President, National Council of Teachers of Mathematics
Professor of Mathematics
Illinois State University
(Normal, Illinois)

Joan Duea; 1991
Elementary Teacher
Price Laboratory School
Professor of Education
University of Northern Iowa
(Cedar Falls, Iowa)

Wade Ellis, Jr.; 1991
Instructor of Mathematics
West Valley College
(Sarasota, California)

Shirley M. Frye; 1990
President, National Council of Teachers of Mathematics
Director of Curriculum and Instruction
Scottsdale School District
(Scottsdale, Arizona)

NAS Andrew M. Gleason; 1989
Hollis Professor of Mathematicks and Natural Philosophy
Harvard University
(Cambridge, Massachusetts)

David R. Johnson; 1989
Past-President, National Council of Supervisors of Mathematics
Chairman, Mathematics Department
Nicolet High School
(Glendale, Wisconsin)

Donald L. Kreider; 1990
Vice Chairman, Mathematics and Computer Science Department
Dartmouth College
(Hanover, New Hampshire)

NAS Martin D. Kruskal; 1990
Professor of Mathematics and Astrophysical Sciences
Princeton University
(Princeton, New Jersey)

Katherine Layton; 1990
Mathematics Teacher
Beverly Hills High School
(Beverly Hills, California)

Steven J. Leinwand; 1990
Mathematics Consultant
Connecticut State Department of Education
(Hartford, Connecticut)

NAS Richard S. Lindzen; 1991
Sloan Professor of Meteorology
Massachusetts Institute of Technology
(Cambridge, Massachusetts)

Gail Lowe; 1990
Principal
Acacia Elementary School
(Thousands Oaks, California)

Steven Meiring; 1991
Mathematics Specialist
Ohio State Department of Education
(Columbus, Ohio)

Jose P. Mestre; 1991
Associate Professor of Physics
University of Massachusetts
(Amherst, Massachusetts)

Leslie Hiles Paoletti; 1991
Chairman
Department of Mathematics and Computer Science
Choate Rosemary Hall
(Wallingford, Connecticut)

Henry O. Pollak; 1989
Assistant Vice President (Retired)
Mathematical, Communications and Computer Sciences Research Laboratory
Bell Communications Research
(Morristown, New Jersey)

Anthony Ralston; 1989
Professor of Computer Science and Mathematics
State University of New York
(Buffalo, New York)

Member and Liaison from Commission on Behavioral and Social Sciences and Education

Lauren B. Resnick; 1990
Director, Learning Research and Development Center
Professor of Psychology
University of Pittsburgh
(Pittsburgh, Pennsylvania)

Yolanda Rodriguez; 1990
Mathematics Teacher
Martin Luther King Open School
(Cambridge, Massachusetts)

Frederick A. Roesch; 1989
Senior Vice President, Global Electronic Marketing
Citibank, N.A.
(New York, New York)

Thomas Romberg, 1990
Director, National Center for Research in Mathematical Sciences Education
Professor of Curriculum and Instruction
University of Wisconsin
(Madison, Wisconsin)

NAS Isadore M. Singer; 1991
Institute Professor
Department of Mathematics
Massachusetts Institute of Technology
(Cambridge, Massachusetts)

Lynn Arthur Steen; 1992
Chairman, Conference Board of the Mathematical Sciences
Chairman, Council of Scientific Society Presidents
Professor of Mathematics
St. Olaf College
(Northfield, Minnesota)

Manya S. Ungar; 1991
President, The National PTA
(Chicago, Illinois)

Zalman Usiskin; 1991
Director, School Mathematics Project
Professor of Education
University of Chicago
(Chicago, Illinois)

Nellie C. Weil; 1990
Past-President
National School Boards Association
(Montgomery, Alabama)

Liaison from Commission on Physical Sciences, Mathematics and Resources

Guido L. Weiss; 1990
Elinor Anheuser Professor
Department of Mathematics
Washington University
(St. Louis, Missouri)

Members who resigned during the reporting period:

Kenneth M. Hoffman
Professor of Mathematics
Massachusetts Institute of Technology
(Cambridge, Massachusetts)

Ted Sanders
Undersecretary
U.S. Department of Education
(Washington, DC)

Staff Officer

Marcia P. Sward
Executive Director